

Bioindicators of Water Quality Quick-Reference Guide

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This publication shows aquatic insects that can be used as bioindicators of water quality in Indiana waterways. Bioindicators are biological systems that are sensitive to environmental changes and, therefore, can indicate when pollution is present in the water.

A tolerance score is included for each insect in this publication. The tolerance score, ranging from 0–10, represents the insect's sensitivity to pollution and can be used to estimate the quality of the water in which the insect was found. Insects with a score of 0 are intolerant to pollution, meaning they cannot tolerate any water pollution, while insects with a score of 10 are very tolerant of polluted water.

Materials Needed

- dip net
- white plastic pail, bowl, or dishpan (Note: The white color makes it easier to see the insects.)
- 2–3 white styrofoam egg cartons or plastic ice cube trays
- data sheet—available online at: www.four-h.purdue.edu/natural_resources/ (select “Resources for Educators” and “Bioindicators”)

Instructions

- Locate a body of water (e.g., stream, pond, lake) to sample. The water should only be at most knee deep and allow easy access for obtaining the sample. Make sure you have permission to sample the water.
- Dip the pail in the water to be sampled.
- Collect insect samples from all habitats within a 200-foot section of that body of water, and place them in the pail. Jab your dip net against the vegetation and into mud or sand at the bottom to collect insects. Scrape the underside of rocks and logs into the net.
- Collect insects for 45 minutes.
- Using the ice cube tray, sort the insects that look the same into the different compartments of the tray using your hand or forceps. Be sure to put some water in the ice cube tray first to keep the insects from drying out.
- Use the bioindicator flash cards or quick reference guide to identify the insects. Record the number of insects from each insect family you identify on the data sheet.
- Place the insects back in the water when you are finished.
- Complete the calculations described in the next section to determine the quality rating.

Resources

- U.S. Environmental Protection Agency (EPA)
- About Biological Integrity and Indicators: www.epa.gov/bioindicators/html/about.html
- Invertebrates as Indicators (look for Bugs as Indicators of Water Quality): www.epa.gov/bioindicators/html/invertebrate.html
- Bugguide.net (hosted by Iowa State University Entomology): www.bugguide.net

Biotic Index	Water Quality Rating	Degree of Organic Pollution
0.00–3.75	excellent	organic pollution unlikely
3.76–4.25	very good	slight organic pollution possible
4.26–5.00	good	some organic pollution probable
5.01–5.75	fair	fairly substantial pollution likely
5.76–6.50	fairly poor	substantial pollution likely
6.51–7.25	poor	very substantial pollution likely
7.26–10.0	very poor	severe organic pollution likely

Assessing the Water Quality of a Site

For each insect family group:

- Record the number of insects found for each species listed.
- Multiply the Tolerance Value by the Number Found, and enter the result under Family Tolerance Score.
- Sum the Number Found and Family Tolerance Score columns (Order Totals).

For each insect order:

- Transfer the Order Totals to the Order Summary section.
- Sum the Number Found and Order Tolerance Score columns (Grand Total).
- Determine the Biotic Index by dividing the Grand Total Tolerance Score by the Grand Total Number Found.
- Use the biotic index in the table provided to estimate the water quality rating and degree of organic pollution.

- Hoosier Riverwatch (provides training on this and many other water-related topics): <http://www.in.gov/dnr/nrec/3046.htm>
- Volunteer Stream Monitoring Training Manual (download, 13.7 MB): http://www.in.gov/dnr/nrec/files/nc-Riverwatch_Manual.pdf; Chapter 5 covers biological monitoring.
- Hoosier Riverwatch events calendar: <http://www.in.gov/dnr/nrec/>

Coleoptera

Beetles



Dryopidae
Long-toed Water Beetle



Dytiscidae (larvae)
Predaceous Diving Beetle



Dytiscidae (adult)
Predaceous Diving Beetle



Elmidae (larvae)
Riffle Beetle



Elmidae (adult)
Riffle Beetle



4
Gyrinidae (larvae)
Whirligig Beetle



4
Gyrinidae (adult)
Whirligig Beetle



7
Haliplidae (larvae)
Crawling Water Beetle



7
Haliplidae (adult)
Crawling Water Beetle



5
Hydrophilidae (larvae)
Water Scavenger Beetle



5
Hydrophilidae (adult)
Water Scavenger Beetle



4
Psephenidae (larvae)
Water Penny



6 pale forms
8 red forms
Chironomidae
Non-biting Midge

Diptera

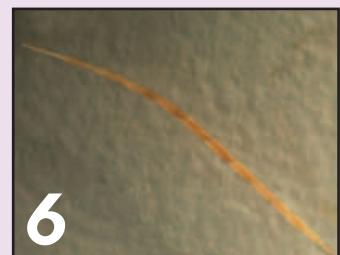
Flies



2
Athericidae
Aquatic Snipe Fly



0
Blephariceridae
Net-winged Midge



6
Ceratopogonidae
Biting Midge



8
Chaoboridae
Phantom Midge



8
Culicidae
Mosquito



1
Dixidae
Dixid Midge



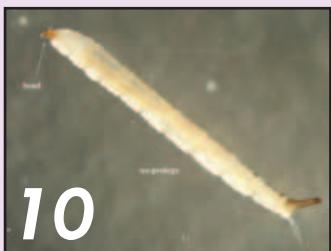
6
Empididae
Aquatic Dance Fly



6
Ephydriidae
Shore Fly



6
Muscidae
House Fly, Stable Fly,
Green Bottle Fly



10

Psychodidae

Moth Fly



3

Tipulidae

Crane Fly



4

Ephemeridae

Common Burrowing Mayfly



4

Potamanthidae

Hacklegill Mayfly



6

Sciomyzidae

Marsh Fly



Ephemeroptera Mayflies



6

Simuliidae

Black Fly



4

Baetidae
Small Minnow Mayfly

8

Stratiomyidae

Soldier Fly



3

Baetiscidae
Armored Mayfly

10

Syrphidae

Rattailed Maggot



7

Caenidae
Small Square-gill Mayfly

6

Tabanidae

Horse Fly, Deer Fly



1

Ephemerellidae
Spiny Crawler Mayfly

2

Polymitarcyidae
Pale Burrowing Mayfly

4

Gelastocoridae

Toad Bug



7

Siphlonuridae
Primitive Minnow Mayfly

10

9

Hemiptera Aquatic Bugs

Belostomatidae
Giant Water Bug

9

Corixidae
Water Boatman**Undetermined****Gelastocoridae**
Toad Bug



Undetermined

Gerridae
Water Strider



Undetermined

Hebridae
Velvet Water Bug



Undetermined

Hydrometridae
Water Measure



Mesovelidiidae
Water Treader



5

Naucoridae
Creeping Water Bug



8

Nepidae
Water Scorpion



Undetermined
Notonectidae
Backswimmer



Pleidae
Pygmy Backswimmer



Saldidae
Shore Bug



6

Veliidae
Broad-shouldered Water Strider



Lepidoptera

Aquatic Moths



5

Pyralidae
Aquatic Caterpillar

Megaloptera

Alderflies, Dobsonflies, and Fishflies



0

Corydalidae
Dobsonfly



4

Sialidae
Alderfly



9

Coenagrionidae
Narrow-winged Damselfly

Odonata

Damselflies and Dragonflies



1

Gomphidae
Club-tailed Dragonfly



3

Aeshnidae
Darner



9

Lestidae
Spread-winged Damselfly



5

Calopterygidae
Broad-winged Damselfly



7

Libellulidae
Common Skimmer

Plecoptera Stoneflies



1

Capniidae
Small Winter Stonefly



0

Leuctridae
Roll-winged Stonefly



2

Nemouridae
Brown Stonefly



1

Perlidae
Common Stonefly



2

Perlodidae
Patterned Stonefly

Trichoptera Caddisflies



1

Brachycentridae
Humpless Casemaker Caddisfly



0

Glossosomatidae
Saddle Casemaker Caddisfly



3

Helicopsychidae
Snail Casemaker Caddisfly



4

Hydropsychidae

Common Net Spinner Caddisfly



4

Hydroptilidae

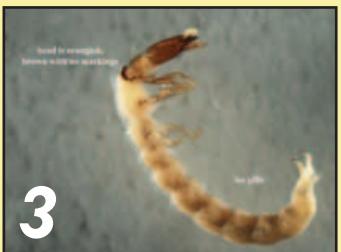
Micro Caddisfly



4

Limnephilidae

Northern Casemaker Caddisfly



3

Philopotamidae

Finger Net Caddisfly



4

Phryganeidae

Giant Casemaker Caddisfly



1

Lepidostomatidae

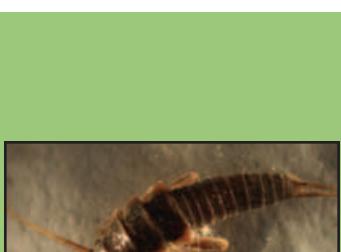
Lepidostomatid Casemaker



4

Leptoceridae

Long Horned Casemaker



0

Pteronarcyidae
Giant Stonefly



2

Taeniopterygidae
Winter Stonefly

Using this guide with the data sheets

Coleoptera Beetles



5

Dryopidae
Long-toed Water Beetle



5

Dytiscidae (larvae)
Predaceous Diving Beetle



5

Dytiscidae (adult)
Predaceous Diving Beetle

Common Name

Family Name

Tolerance Value

Coleoptera (Beetles)

Family	Tolerance Value	Number Found	Family Tolerance Score
Dryopidae	5	0	0
Dytiscidae	5	2	10
Elmidae	5	0	0
Gyrinidae	4	0	0
Haliporidae	7	0	0
Hydrophilidae	5	3	15
Psephenidae	4	0	0
Order Total		5	25

Order Summary

Order Total	Number Found	Order Tolerance
Coleoptera	5	25
Diptera	6	38
Ephemeroptera	8	28
Hemiptera	5	27
Lepidoptera	2	0
Megaloptera	0	0
Odonata	3	13
Plecoptera	0	0
Trichoptera	6	24
Grand Total	35	155

Biotic Index = [Grand Total Tolerance] / [Grand Total Number Found] = 155/35 = 4.43

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